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FOOD HABITS OF SOME WINTER BIRD VISITANTS.

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INTRODUCTION.

Every year as winter approaches the majority of the birds that have been present during the summer disappear and their places are taken by other species from the north. With few exceptions these winter visitors have nested either in the mountains or in the northern regions. Some of them are rare, and nearly all are known to the people of the United States only as "winter visitants." These birds tend to be erratic in their movements, being present in a locality in large numbers one season and then perhaps wholly absent for several succeeding years. The crossbills and grosbeaks, which feed to a great extent on seeds of various conifers, are the most erratic, not only in their winter migrations but in the time of breeding as well. Our winter bird visitants have interesting habits and behavior, and as they appear when most other birds are scarce they are especially welcome.

Of the species treated in this bulletin,[1] the pine and evening grosbeaks, redpolls, crossbills, and pine siskins are primarily birds of the

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[1] The species treated in this bulletin include several winter bird visitants the food habits of which have not already been published. Numerous species of the sparrow tribe, for instance, besides those here included, are characteristic winter visitors, but their food habits have already been treated in Biological Survey Bulletin No. 15, The Relation of Sparrows to Agriculture, by Dr. Sylvester D. Judd, 1901. The horned larks have a bulletin to themselves, No. 23 of the Biological Survey, by W. L. McAtee, 1905. The hawks and owls are treated by Dr. A. K. Fisher in Bulletin No. 3 of the Biological Survey, 1893; and in Circular No. 61 of the same bureau, 1907. And a number of the characteristic smaller winter birds are discussed in Farmers' Bulletins Nos. 506 and 630.

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wooded country, and seeds or buds of shrubs and trees form a considerable part of their diet. The snow bunting and longspurs are prairie-feeding species, and the seeds of various grasses and weeds form the bulk of their diet. The pipits are insectivorous.

Discussion of the birds of the woodland group may be dismissed with a few words. Too few stomachs of most of these species collected in summer were available to permit conclusions to be drawn regarding the food for that season. In the winter months, however, during which these birds occur commonly in this country, the evidence goes to show they do little good, and none was obtained from stomach examination to indicate that they do any harm. Few reports of damage inflicted by any birds of these species have been recorded, bud-eating being the only source of complaint. Stomach examination shows, however, that in no case is bud-eating a common habit, but one for which local conditions of the food supply are probably responsible.

As for the snow bunting and the various species of longspurs, it can only be said that what economic importance they are shown to have is in connection with weed-seed destruction. While their consumption of weed seed tends in a desirable direction, it is doubtful whether it accomplishes much real good except locally under unusual circumstances. Usually the birds eat only such seeds as remain on the stalk or on the surface of the ground, and where there is no cultivation many more weeds are likely to sprout and start to grow than can possibly mature. As a result of this, many plants are smothered by the few that survive, and it seems evident that uncultivated ground invariably produces each year the maximum number of mature weed plants that the season, soil, and climatic condition will allow.

Collinge has shown by investigations in England that some at least of the English finches are responsible for the spread of certain weeds, because seeds capable of germination pass through the digestive tract. Judd carried on a few experiments with English sparrows in this country and found that in no case were seeds voided in a condition to germinate. As far as the crossbills, grosbeaks, redpolls, and siskins are concerned there is little chance of seeds being distributed, as these birds have the habit of shelling practically all the seeds eaten. In the case of the longspurs and snow bunting it is believed that from the condition of the seeds in their stomachs, very few are passed in a condition to germinate.

It seems that in this country, while these birds do little or no good from an economic standpoint, they do no damage and may well be left unmolested.

The pipits, on the other hand, are found to be valuable insectivorous birds. The common pipit and the Sprague pipit are similar in appearance and probably have much the same habits, though study material in the case of the latter is as yet insufficient to determine this definitely. The common pipit is found to be a constant natural destroyer of the white grub and the cotton-boll weevil, two of the worst of southern crop pests. It is especially to the interest of southern farmers to protect this bird at all times, as it is one of the most efficient bird enemies of the cotton-boll weevil.

EVENING GROSBEAK *(Hesperiphona vespertina).*

(PLATE I.)

The large beak and the contrasting plumage of yellow, black, and white make the evening grosbeak an easily recognized species. Breeding in the western United States and Canada, during the winter it is occasionally seized with a wandering impulse which carries it east to New York, Pennsylvania, and adjacent States. Usually, however, it chooses to spend this season in the West, wandering over the country in flocks of varying numbers.

For the study of the food habits of this grosbeak, 127 stomachs collected in 14 States and Canada were available. Of these 88 were taken in the winter months (October to March, inclusive), or at the time when the birds commonly appear about human habitations. The remaining 39 were taken in summer.

Winter food.—Ornithologists who have been fortunate enough to observe this interesting bird report that the chief elements in the diet are various kinds of wild fruit, seeds of ash, maple, box elder, and conifers, and buds. Except for this last item these observations are verified by stomach examination. No buds were found in the stomachs, and this seems to indicate that the bud-eating habit is not so general as has been supposed. It is worthy of note that about 50 stomachs taken in Ontario in the winter of 1889–90, and examined by various members of the Canadian Institute, contained no buds.[2] It was found that seeds of several different trees and shrubs constituted the food supply of the birds while they remained in that locality.

No trace of animal matter was found in the 88 winter stomachs, seeds and fruit constituting the entire contents. Seeds of wild fruits formed 39.63 per cent; winged seeds (maple, ash, and box elder), 37.96 per cent; coniferous seeds, 14.5 per cent; and miscellaneous seeds, mast, and rubbish, the remainder. The most important seeds of wild fruits in the food for this period were cherry pits (*Prunus*), found in 23 stomachs and amounting to 17.48 per cent of the total food; dogwood (*Cornus*), identified in 63 stomachs, 13.77 per cent; mountain-ash (*Sorbus*), taken from 13 stomachs, 3.82 per cent; and snowberry (*Symphoricarpos*) in 11 stomachs, forming 1.77 per cent of the food of the 88 birds. Of the winged seeds, ash seeds (*Fraxinus*) were found in 4; maple (*Acer*) in 30; and box elder (*Acer negundo*) in 13 stomachs. Juniper berries had been eaten by 14 birds, and seeds of other conifers by 13.

The nature of the contents of certain stomachs of this species gives a vivid idea of the shearing or crushing power of the beak. The seeds of cherries were broken easily and a whole one was rarely found. The flattened seeds of snowberry were split longitudinally in nearly every case.

Summer food.—The food for the summer season, as determined by an examination of 39 stomachs, is 20.82 per cent animal and 79.18 per cent vegetable matter.

The vegetable food was of much the same character as that taken during the winter season. Seeds of wild fruits are 37.87 per cent of the food for the summer compared with 39.63 per cent during

[2] Trans. Canadian Inst., vol. 3, p. 124, 1891–92.

the winter. The greatest difference is in the relative quantities of winged seeds and those of conifers. The percentage of the latter rises from 14.5 per cent during the winter to 28.45 per cent in summer, while in the case of winged seeds the amount taken falls from 37.96 per cent in winter to 2.79 per cent in summer. This variation is easily understood by considering the habits of the evening grosbeak. During the winter the birds spread over the Northern States into localities where maples, ashes, and box elders are very common and conifers relatively scarce; during the breeding season they frequent coniferous forests, where seeds of these forms are easily obtained. Weed seed and rubbish complete the vegetable food.

Beetles and caterpillars are the chief animal food, although small wasps and ants (Hymenoptera), bugs (Hemiptera), and spiders were also eaten. Among the beetles were found a few of the useful predacious ground beetles (Carabidae), which, however, amounted to less than 1 per cent of the food. Similar small quantities of weevils and click-beetles, both harmful forms, had been taken. The bulk of the beetles eaten was of the leaf-eating scarabaeid genus *Dichelonycha*, which feeds on pine, willow, hickory, and other trees and shrubs. One bird had taken 41 of these beetles and another, 10. Caterpillars to the extent of 11.49 per cent of the total food had been devoured; and as caterpillars with few exceptions may be classed as harmful, this may be counted in the bird's favor.

Conclusions.—The evening grosbeak is of little economic importance. Its food consists largely of the seeds and fruits of various trees and shrubs, none of which are of any material value to man. It might turn its attention to cultivated fruits if they were grown in its summer home, but neither this possibility nor the slight harm done by bud-eating justify an unfavorable attitude toward the species.

Food items of the evening grosbeak, identified to the genus or species, as determined by the examination of 127 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Pinaceae.	
Pinus ponderosa (western yellow pine)	11
Juniperus monosperma (cherrystone juniper)	2
Juniperus sp. (juniper)	12
Rosaceae.	
Rubus sp. (blackberry)	3
Malaceae.	
Malus malus (apple)	1
Sorbus sp. (mountain-ash)	14
Amelanchier sp. (serviceberry)	4
Amygdalaceae.	
Prunus sp. (wild cherry)	26
Anacardiaceae.	
Rhus trilobata (skunkbush)	1
Aceraceae.	
Acer sp. (maple)	35
Acer negundo (boxelder)	11
Rhamnaceae.	
Ceanothus sp. (Jersey-tea)	1
Malvaceae.	
Hibiscus sp. (mallow)	2
Cornaceae.	
Cornus occidentalis (dogwood)	1
Cornus sp. (dogwood)	67
Oleaceae.	
Fraxinus sp. (ash)	4
Solanaceae.	
Solanum sp. (nightshade)	1
Caprifoliaceae.	
Symphoricarpos sp. (snowberry)	11
Sambucus (elder)	1

(LOWER [redacted] FIGURE) AND EVENING GROSBEAK [redacted]

PINE GROSBEAK (UPPER) 2339M

B2338M

RED CROSSBILL (UPPER FIGURE) AND WHITE-WINGED CROSSBILL (LOWER)

ANIMAL FOOD.

Lygaeidae (chinch bugs, etc.).		Lucanidae (stag-beetles).	
Nysius sp	1	*Platycerus quercus*	1
Carabidae (ground-beetles).		Tenebrionidae (darkling-beetles).	
Platynus sp	1	*Blapstinus* sp	1
Scarabaeidae (leaf-chafers, dung-beetles, etc.).			
Dichelonycha sp	2		

PINE GROSBEAK (*Pinicola enucleator*).

(PLATE I.)

The handsome red and slate-colored pine grosbeak, a bird breeding in the Canadian forests, in Alaska, and in the mountains of the United States, also appears in the lower areas of the Northern States in winter. As is the habit of several other species discussed in this bulletin, the pine grosbeak wanders more or less irregularly about the country in flocks of considerable size. This species is widely distributed in northern parts of both the Old and New Worlds.

For the study of the food habits of this grosbeak 394 stomachs collected in 13 States, Alaska, and 5 Provinces of Canada were available. Of these, 365 were collected during the winter months and only 29 during the summer season (April to September, inclusive). On account of this unequal seasonal distribution of the material and the fact that this species is of more importance in this country during the winter, the food habits of the pine grosbeak for the two seasons are considered separately.

Winter food.—One of the most striking features of the literature pertaining to the diet of this species is the number of apparently contradictory statements as to its food preferences. A number of different writers refer to its fondness for buds; John O'Leary [3] states that it feeds principally on mountain ash berries; Ernest Thompson Seton [4] confirms this and adds the seeds of black ash as another favorite food. E. A. Mearns [5] reports that the seeds of maple and red cedar berries are the staple articles of diet, but adds seeds of conifers and weeds, frozen apples, and all kinds of berries and buds as other elements eaten. Elliott Coues [6] believes that its principal food is pine seed supplemented by seeds of birch and alder; and Baird, Brewer, and Ridgway [7] state that red cedar berries were the chief food in eastern Massachusetts during the winter of 1835, and record the grosbeak as doing considerable damage in 1869–70 to the fruit buds of apples and pears. William Brewster,[8] in a discussion of a flight of this species into eastern Massachusetts, gives a table of the food items in which are included the seeds of ash, various conifers, apples, waxwork, ailanthus, weeds, and grass; buds of maple, ash, conifers, and a few other trees; and soft fruits of apple, moun-

[3] Forest and Stream, vol. 16, p. 28, Feb. 10, 1881.
[4] The Auk, vol. 7, p. 211, April, 1890.
[5] Bul. Essex Inst., vol. 2, p. 201, 1879.
[6] Birds of the Northwest, p. 105, 1874.
[7] North American Birds, vol. 1, p. 455, 1875.
[8] A remarkable flight of pine grosbeaks (*Pinicola enucleator*), The Auk, vol. 12, pp. 245–256, July, 1895.

tain ash, black alder; honeysuckle, and other shrubs. He also states (p. 251)—

> the chief food of the grosbeaks consisted of the seeds of the white ash (*Fraxinus americana*) and of the apple, the fruit of the apple and of the American and European mountain ash (*Pirus americana* and *Pirus aucuparia*) and of the buds of the sugar maple (*Acer saccharinum*), and Norway spruce (*Abies excelsa*). The birds apparently attacked the fruit and buds of other plants only when the supply of their favorite food was exhausted.

As nearly all the above-mentioned items were found in the stomachs examined, the apparent contradictions may be explained by a consideration of the feeding habits of the birds and the locality in which they were observed. In common with the evening grosbeak and the two species of crossbills, the pine grosbeak feeds in flocks which usually settle down in one tree or more and feed for some time, making a full meal on the one variety of fruit or seed if not disturbed. Local conditions, such as relative abundance and availability, probably govern the selection of food. For example, a series of stomachs from New Hampshire contained little except seeds of blackberries (*Rubus*) and the staminate flower buds of pine. When both gizzard and gullet were examined it was usual to find the gizzard filled with one of these foods and the gullet with the other. This would indicate that the readily available food supply in the locality was limited to these two items and that the birds in feeding were making a full meal on one or the other. Stomachs of a second series from British Columbia were filled with the seeds of snowberry (*Symphoricarpos*).

Other similar instances might be cited, each indicating that an examination of the stomachs from either locality alone would result in an incorrect conception of the food of the species. With 365 stomachs collected from a wide territory for the basis of the discussion of the pine grosbeak's winter diet, this difficulty is largely overcome.

The winter food of the pine grosbeak is almost exclusively vegetable, 99.1 per cent of the entire diet being derived from the plant world. In considering the results of the examination of the 365 stomachs, two items stand out because of their relatively high percentages, and the large number of stomachs in which they occurred. These two were *Rubus* seeds and coniferous buds. The seeds occurred in 207 stomachs and amounted to 14.37 per cent of the total winter food. Buds were found in 166 stomachs and made 24.22 per cent of the season's food. Both had been taken from many different regions by birds which were collected in every winter month. Practically all buds were the staminate flower buds of pine, although a few leaf buds and buds of spruce (?) were included in this item. Two hundred and seventeen winter stomachs contained one or both of these foods, which together constituted 38.59 per cent of the total contents. It is apparent from these data that the fruit of *Rubus* and buds of conifers are the staple winter food of this species.

Other items show high percentages, but this is because they constitute the entire content of a few stomachs from one locality rather than because there is a general use of the food over an extended area. A conspicuous example of this is the snowberry, which amounted to 17.3 per cent and had been eaten almost exclusively by 69 birds from one place. Weed seeds formed 7.67 per cent of the

diet, of which seven stomachs from Ontario filled with these seeds contributed half. Juniper berries and other coniferous seeds, amounting to 4.15 per cent, were mostly obtained by birds collected in Connecticut, and birds from Ontario and Massachusetts had eaten most of the maple (2.78 per cent) and ash (1.25 per cent) seeds taken.

A great variety of wild fruit contributed 14.34 per cent of the food supply. The fruits most often found and the number of stomachs in which they were identified were thornapples (*Crataegus*) in 19, dogwood (*Cornus*) in 38, mountain-ash (*Sorbus*) in 14, huckleberries (*Gaylussacia*) in 13, blueberries (*Vaccinium*) in 8, crowberries (*Empetrum nigrum*) in 21, and blackhaws (*Viburnum*) in 7. Most of these fruits were eaten probably for the seeds, as very little pulp was found. The fruit pulp of mountain-ash, crowberries, and blueberries, however, was frequently taken.

Mast amounted to 5.66 per cent of the food and probably was composed largely of beechnuts or acorns. Clarence Birdseye has observed the species feeding freely on beechnuts, but this does not seem to be a common habit.

Although some complaint concerning bud eating by the pine grosbeak has been made, stomach examination fails to show that the habit is general. Thirty-eight birds had taken buds (other than those of conifers) in varying quantities, to the extent of 4.72 per cent of the winter diet. A series of stomachs from Colorado contained buds of willow (*Salix*), and a few birds from various localities had eaten those of maple (*Acer*). While these figures show that relatively few buds are eaten by the pine grosbeak, the possibility of local damage is recognized. A large flock of these birds might do considerable injury in an orchard. Such a possibility does not, however, justify a general condemnation of the bird, as local methods of control can be readily adopted.

Eating frozen apples either for the sake of the seed or pulp is another habit which has often been noticed. Stomach examination, even of birds labeled "feeding on frozen apples," fails to confirm these observations, although a few fragments of seeds and pulp not positively identified might have been apple. The pine grosbeak undoubtedly takes such food, at least occasionally; and if the gullets as well as the gizzards of birds collected while in the act of eating frozen fruit had been preserved, such material would probably have been found. Bits of pine needles, wood, grass, and fragments of unidentified seeds (2.64 per cent) complete the vegetable food.

The animal food taken in winter is of little importance, amounting to only 0.9 per cent of the total. Fragments of small beetles, hymenopterans, and flies, together with weevil larvae, are the chief items, and as they were nearly all found in the coniferous buds it seems certain that they were accidentally devoured with such food.

Summer food.—With only 29 stomachs collected in this season, the material is too scanty to justify monthly averages, and the entire number will be considered together. Of the contents of these stomachs, 16.17 per cent was animal food and 83.83 per cent vegetable.

The vegetable food differs from that taken during the winter months chiefly in the absence of maple and ash seeds and in a higher percentage of wild fruit. *Rubus* seeds and flower buds of pine, which are the staple articles of diet in winter, were found in seven stomachs

and amounted to 7 per cent of the summer food. Seeds of conifers (particularly spruce) amounted to 12.37 per cent, and weed seed to 19.97 per cent of the contents of these stomachs. Wild fruits of many kinds enter into the diet at this season and amount to 32.8 per cent. Buds of deciduous trees, mast, and miscellaneous items complete the list of vegetable matter.

The animal food was very finely comminuted and could not be specifically identified. Grasshoppers, ants, spiders, and caterpillars constituted the bulk of it (15.08 per cent), and small flies and beetles the remainder.

Conclusions.—The pine grosbeak has only one questionable habit, that of eating buds. Examination of 394 stomachs shows that a large portion of the buds taken are coniferous, of no economic importance; these, with wild fruit, furnish this bird practically all its food. The high percentage of wild fruit taken indicates that if this species should come within reach of cultivated small fruits, these would probably suffer. Under present conditions this is not likely to happen, and the species should be protected because of its beauty and the interest aroused by its appearance.

Food items of the pine grosbeak, identified to the genus or species, as determined by the examination of 394 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Buds.	
Pinaceae.	
Pinus sp. (pine)	168
Salicaceae.	
Salix sp. (willow)	11
Aceraceae.	
Acer sp. (maple)	2
Seeds and fruits.	
Pinaceae.	
Pinus flexilis (limber pine)	1
Picea sp. (spruce)	3
Juniperus virginiana (red-cedar)	3
Thuja sp. (arborvitae)	1
Cyperaceae.	
Carex sp. (sedge)	2
Smilacaceae.	
Smilax sp. (greenbrier)	1
Iridaceae.	
Iris sp. (iris)	1
Polygonaceae.	
Rumex sp. (dock)	1
Polygonum sp. (smartweed)	21
Amaranthaceae.	
Amaranthus sp. (pigweed)	1
Portulacaceae.	
Montia sp. (water-chickweed)	2
Papaveraceae.	
Argemone sp. (prickly poppy)	1
Brassicaceae.	
Brassica sp. (mustard)	1
Barbarea sp. (winter cress)	51
Grossulariaceae.	
Ribes sp. (currant)	1
Rosaceae.	
Potentilla sp. (cinquefoil)	2
Fragaria sp. (strawberry)	2
Rubus sp. (blackberry)	212
Malaceae.	
Sorbus sp. (mountain-ash)	15
Amelanchier sp. (service-berry)	2
Crataegus sp. (redhaw)	19
Amygdalaceae.	
Prunus sp. (wild cherry and plum)	2
Empetraceae.	
Empetrum nigrum (crowberry)	24
Anacardiaceae.	
Rhus glabra (smooth sumac)	1
Aceraceae.	
Acer sp. (maple)	23
Elaeagnaceae.	
Lepargyrea canadensis (buffaloberry)	2
Lepargyrea argentea (buffaloberry)	1
Araliaceae.	
Aralia nudicaulis (wild sarsaparilla)	2
Cornaceae.	
Cornus canadensis (bunchberry)	14
Cornus sp. (dogwood)	26
Ericaceae.	
Rhododendron lapponicum	1

Vacciniaceae.
Gaylussacia sp. (huckleberry) 13
Vaccinium sp. (blueberry) 11
Oleaceae.
Fraxinus sp. (ash) 7
Solanaceae.
Solanum sp. (nightshade) 1
Caprifoliaceae.
Lonicera involucrata (bearberry honeysuckle) 4
Lonicera sp. (honeysuckle) 2
Caprifoliaceae—Continued.
Symphoricarpos sp. (snowberry) 68
Viburnum sp. (blackhaw) 7
Ambrosiaceae.
Ambrosia elatior (ragweed) 3
Ambrosia sp. (ragweed) 31
Cichoriaceae.
Leontodon taraxacum (dandelion) 2
Hieracium sp. (hawkweed) 1

ANIMAL FOOD.

Acrididae (grasshoppers).
Melanoplus sp. 2
Chrysomelidae (leaf-beetles).
Syneta sp. 1
Vespidae (wasps).
Vespula sp. 1
Formicidae (ants).
Camponotus sp. 3

RED CROSSBILL *(Loxia curvirostra).*

(PLATE II.)

The red crossbill is a northern breeding species, which in the United States nests regularly only in mountains; but more or less irregularly elsewhere, mostly in the Northern States. It is nomadic and may appear in any part of the country at almost any season, but is much more common in winter. While it occurs with a certain degree of regularity only in the Northern and Western States, it has wandered south to Florida and other Gulf States. The dull red (male) or yellow (female) body, dusky wing and tail, and peculiar crossed mandibles make this species conspicuous and easily recognized.

As erratic in its nesting habits as in its winter wanderings, the crossbill breeds at various dates from January to July or later in many widely scattered localities. W. B. Barrows[9] has suggested that the availability of coniferous buds and seeds throughout the year in favored regions makes it possible for this bird to breed at any season. This variation in the breeding season may in some measure account for its unexpected appearance in other localities where it is observed in wandering flocks at irregular intervals. It will usually be found feeding on conifers, the seeds of which are cleverly extracted from the cones by the crossed mandibles. After a few days or weeks thus spent in one locality the birds will suddenly disappear, possibly not to return for many years.

Little attention has been given to the food of this species, and with one or two exceptions writers have been content merely to refer to its fondness for the seeds of conifers. For this reason it is necessary to depend almost entirely on the examination of stomachs for information on its food habits. Two hundred and forty-three stomachs, collected in 17 States, the District of Columbia, and Canada, were examined. They were very irregularly distributed, both seasonally and geographically. New York, the District of Columbia, Virginia, Florida, and Wyoming are well represented, while comparatively little material is available from the other States. The six months from November to April are represented by 202 stomachs,

[9] Michigan bird life, p. 471, 1912.

and the remaining six months by 41. In view of this unequal seasonal distribution, the winter and summer food habits are considered separately.

Winter food.—The fondness of the red crossbill for the seeds of conifers, which has been noticed and commented on by almost every ornithologist who has observed its feeding habits, is borne out by stomach examination. Seeds of conifers, almost the entire contents of 195 stomachs, amounted to 96.47 per cent of the winter food. Practically every seed was shelled, even the thin inner seed coat being removed, leaving only the soft white endosperm and embryo. As the contents of the distended esophagus also were examined when available, the seeds were seen before they had been crushed or digested to any appreciable extent. The condition of these seeds furnishes an admirable illustration of the dexterity with which the peculiar mandibles of this species are used, as many stomachs were filled with seeds that were not scratched or broken in any way during the removal of the seed coats.

The variation in the food of this crossbill seems to be geographical rather than seasonal, and the species of seeds of conifers recognized were from the few that had been swallowed without being hulled. Pines (*Pinus* spp.) are the ones best represented. Seeds recognized as belonging to this genus comprised 78.29 per cent of the food during the winter. That scrub pine (*P. virginiana*) and western yellow pine (*P. ponderosa*) were the species most commonly found was to be expected, as the majority of the stomachs were collected in localities in which these trees predominated. White pine (*P. strobus*) and red pine (*P. resinosa*) also were identified. Other conifers recognized were spruce (*Picea mariana* and *Picea* sp.) and hemlock (*Tsuga canadensis*).

One stomach collected in March was filled with seeds of ragweed (*Ambrosia elatior*) and two contained chiefly mast, 100 and 80 per cent of the contents, respectively. Other vegetable food included bits of wood, pine needles, and a few small fragments of unidentified seeds.

Animal matter amounted to only 1.07 per cent of the winter food and was composed of spiders (found in two stomachs to the extent of 30 and 20 per cent, respectively), caterpillars (in three stomachs, forming 100, 20, and 10 per cent of the contents), and fly larvae in two stomachs (100 and 50 per cent). Probably all these were picked from conifers; and this was certainly true of one caterpillar, as it had been feeding on pine needles.

Summer food.—The material collected during the months from May to October, inclusive, is too scanty to furnish a satisfactory basis for computing monthly food averages. Tabulation of the contents of the 41 stomachs representing this period shows that the percentage of animal food is 18.02 and vegetable food 81.98, compared with 1.07 per cent and 98.93 per cent, respectively, for the winter months.

Coniferous seeds, constituting 68.34 per cent of the total contents, were found in 31 stomachs. The following species were identified: Western yellow pine (*Pinus ponderosa*), shortleaf pine (*P. echinata*), Engelmann spruce (*Picea engelmanni*), and a larch (*Larix*). Seeds of a sedge (*Scirpus*) and of one of the sunflower family (Asteraceae) furnished 1.69 per cent of the food. Unidentified

wild fruit pulp and skins (the entire contents of two stomachs), 4.88 per cent, and rubbish (two stomachs full of bits of wood and other débris and a third partly filled), 7.07 per cent, complete the list of vegetable food.

Coleoptera, both adults and larvae, found in small quantities in six stomachs, made up 2.09 per cent of the summer food. With the exception of one wireworm, the larvae were those of weevils found within the pine seeds. Fragments of Hymenoptera were identified in two stomachs, but they did not amount to as much as 1 per cent of the contents of either. Hemiptera had been taken by eight birds to the extent of 6.56 per cent of the food. Plant-lice (Aphididae) filled one stomach and in three others occurred in smaller quantities. Several birds had eaten spittle insects (Cercopidae). Caterpillars and one moth formed 8.65 per cent of the food. An insect gall found in one stomach and a number of insect eggs in another complete the animal matter.

It is evident that a larger number of stomachs collected at this season would have added other items to the food of the crossbill, as the variety in the diet was considerably greater than in winter. O. W. Knight[10] has listed the following, in addition to the seeds of conifers, as entering into the food of this species: Beetles, ants, plant-lice, larvae of *Vanessa antiopa* (a spring butterfly), and other insects; buds of elm, maple, birch, alder, poplar, and willow; and seeds of birch and alder. He states also that these birds have been reported as feeding on scraps from salt pork barrels.

Otho C. Poling[11] has observed the birds feeding on frozen apples and on buds of cottonwood; Mary Mann Miller[12] saw them feeding on larvae of the forest tent caterpillar (*Clisiocampa disstria*); Thomas McIlwraith[13] has recorded their eating seeds of sunflowers and digging seeds from a squash left out during the winter; and R. P. Currie, of the Bureau of Entomology, also reports them as feeding on sunflower seeds in a North Dakota garden (August 17, 1891).

Both Dr. A. K. Fisher and Merritt Cary have noted crossbills feeding on the ground, picking seeds from fallen cones; and the former has watched them carry small cones to a low branch and hold them while extracting the seeds. Dr. C. Hart Merriam has observed them feeding on beechnuts; C. E. Ward has seen them eating hemp seed; F. S. Dace has reported them feeding on elm seeds; and A. H. Phillips states that he has watched one devouring the fruit of the flowering crab (*Pyrus floribunda*).

Little complaint of damage by this bird has ever been made. A. L. Reed reports that in Broome County, N. Y., in April and May of 1884 the red crossbills did considerable damage to buds of apple, pear, and cherry trees. Townend Glover[14] states that they did considerable damage in the northerly localities by tearing open apples to obtain the seeds. F. H. King[15] says that in midsummer of 1868 the crossbills appeared in great numbers in western Maine and proved very destructive to oats, disappearing again as soon as the harvest

[10] The birds of Maine, p. 378, 1908.
[11] The Auk, vol. 7, p. 239, July, 1890.
[12] The Auk, vol. 16, p. 362, October, 1889.
[13] The birds of Ontario, 2d ed., p. 299, 1894.
[14] U. S. Agricultural Report, 1865–66, p. 42.
[15] Economic relations of Wisconsin birds: Geol. Surv. Wisconsin, vol. 1, 1873–79, p. 534.

was over. Damage of this character is of very sporadic occurrence as shown by the present stomach examinations. No trace of buds or grain was found in any of the stomachs, as would have been the case had bud and grain-eating habits been general with the species.

Conclusions.—From the examination of 243 stomachs it is evident that seeds of various conifers afford the red crossbill its chief sustenance throughout the year. Other food is taken either incidentally, as weevil larvae found within the seeds of pine, or because coniferous seeds are not readily available. As these crossbills destroy no crops and do not feed to any extent upon insects either beneficial or injurious, they are of little economic importance. The only apparent source of damage would be found in the bud-eating habit, and from the results obtained in this investigation, appreciable injury of this kind seems a remote possibility. The red crossbill may well be afforded protection because of its interesting ways and its presence at a time of year when bird life is scarce.

Food items of the red crossbill, identified to the genus or species, as determined by the examination of 243 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Pinaceae.		Pinaceae—Continued.	
Pinus strobus (white pine)	2	*Picea engelmanni* (Engelmann spruce)	1
Pinus virginiana (scrub pine)	52	*Picea* sp. (spruce)	3
Pinus echinata (shortleaf pine)	1	*Larix* sp. (larch)	1
Pinus ponderosa (western yellow pine)	36	*Tsuga canadensis* (hemlock)	5
Pinus resinosa (red pine)	8	Cyperaceae.	
Pinus sp. (pine)	100	*Scirpus* sp. (bulrush)	1
		Ambrosiaceae.	
		Ambrosia elatior (ragweed)	1

ANIMAL FOOD.

Cicindelidae (tiger beetles).		Vipionidae (parasitic wasps).	
Cicindela sp	1	*Microbracon* sp	1

WHITE-WINGED CROSSBILL *(Loxia leucoptera).*

(PLATE II.)

The white-winged crossbill is a bird of more northern distribution and appears more rarely and irregularly within the borders of the United States than the preceding species. It closely resembles the red crossbill in habits and general appearance, the most noticeable difference being the two white wing-bars which give to this bird its name. It usually appears in small flocks. Occasionally the two species are found flocking together.

Fifty-two stomachs were available for the study of the food habits of the white-winged crossbill; but as over half of these were collected in two widely separated localities in February and September, the material is very unequally distributed geographically and seasonally. For this reason no attempt is made to ascertain monthly percentages and the entire number is treated as a unit. Of the total contents of these 52 stomachs 6.88 per cent is animal matter and 93.12 per cent vegetable.

Vegetable food.—Arthur H. Norton reports by letter that this bird feeds on seeds of hemlock and spruce, but that he failed to see it alight in pine trees, although this tree is abundant; nor did he find pine seeds in stomachs. Other ornithologists, however, include pine among the coniferous seeds eaten by this crossbill.

As in the case of the red crossbill, conifers furnish the bulk of the food supply, 76.21 per cent of the total stomach contents being seeds of such trees. Curiously enough, spruce (*Picea*) and hemlock (*Tsuga canadensis*) furnished the bulk of coniferous seeds that could be identified. No pine seed was found in a condition to be recognized; but as nearly 24 per cent of the food was entered as unidentified "coniferous seeds," the probabilities are that a part of this was pine seed. Seventeen birds taken in February had eaten hemlock to the extent of nearly half their food, the remaining 50 per cent being coniferous seeds not further identified. Eleven birds collected in September had taken nothing but spruce. One October stomach was filled with the seeds of balsam fir (*Abies balsamea*), and one taken in November contained juniper berries (*Juniperus* sp.). As in the red crossbill, the variation in the character of the coniferous seeds in the diet seems to be geographical. The stomachs mentioned as containing largely hemlock were collected in a region where hemlock is the common conifer, and the same is true of those which were filled with spruce. It is probably this factor, rather than any aversion to pine seeds, that accounts for the lack of evidence that pine seeds contribute to the food of the species.

Two birds had made their entire meal on buds, which amounted to 3.84 per cent of the food. This is the only evidence found in the stomachs of either species of crossbill which indicates a bud-eating habit. One stomach, one-quarter filled with seeds of huckleberries (*Gaylussacia*) and crowberries (*Empetrum nigrum*), contained the only fruit eaten. Five birds had devoured weed seed to the extent of 9.61 per cent of the total food. Of these, three had made an entire meal on sunflower seeds (*Helianthus*), one had eaten ragweed (*Ambrosia*) to the exclusion of other food, and one had partaken equally of ragweed and foxtail grass (*Chaetochloa*). Vegetable rubbish and bits of unidentified seeds, amounting to 2.98 per cent, complete the list of vegetable food.

Animal food.—Animal food made up 6.88 per cent of the contents of the 52 stomachs and was composed of caterpillars and other larvae, 1.68 per cent, and an unidentified animal substance, 5.20 per cent. The latter was found in three stomachs collected in June in the same locality. Digestion was far advanced and the material was so finely comminuted that further identification was impossible. It was composed probably of fragments of pupal cases of some insect.

One of the few records of this crossbill eating freely of animal food is that of W. C. Fish,[16] who observed a large flock feeding on the larvae of the pitch-pine sawfly, *Diprion* (*Neodiprion*) *pinus-rigida*, which was very abundant at that time. According to his report the birds did their work so thoroughly that the pest was rare the next summer. C. J. Maynard [17] has found stomachs filled with

[16] Packard, A. S., Insects injurious to forest and shade trees, p. 759, 1890.
[17] Coues, Elliott, New England bird life, vol. 1, p. 220, 1883.

cankerworms. Many other observers have recorded white-winged crossbills as feeding on the seeds of conifers and weeds; and the birds are also reported to have eaten frozen apples, but no evidence of this was found in the stomachs examined.

Conclusions.—It is apparent that the white-winged, as well as the red, crossbill depends to a large extent upon seeds of conifers for its sustenance throughout the year. The beak is especially adapted for extracting these seeds from the cones in which they grow, and it is probable that the bird could subsist entirely upon such food. In the great coniferous forests the eating of pine seed is of no economic importance, and as the few insects the bird eats are harmful the balance would seem to be slightly in its favor. The only source of complaint against the white-winged crossbill is found in the bud-eating habit, and in view of the comparative rarity of the species any injurious effect would be improbable even if buds furnished a far greater percentage of its diet than is shown by this study. So long as this bird continues as harmless in its food habits as at present known, it fully deserves the protection accorded it.

Food items of the white-winged crossbill, identified to the genus or species, as determined by the examination of 52 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Pinaceae.		Empetraceae.	
Picea sp. (spruce)	19	*Empetrum nigrum* (crowberry)	1
Tsuga canadensis (hemlock)	8	Vacciniaceae.	
Abies balsamea (balsam fir)	1	*Gaylussacia* sp. (huckleberry)	1
Juniperus sp. (juniper)	1	Ambrosiaceae.	
Poaceae.		*Ambrosia* sp. (ragweed)	2
Chaetochloa sp. (foxtail grass)	1	Asteraceae.	
		Helianthus sp. (sunflower)	2

HOARY REDPOLL (*Acanthis hornemanni exilipes*).

Only 11 stomachs of this rare straggler from the north were available for examination, and 6 of these were from Fort Simpson, Canada. E. A. Preble[18] reported the hoary redpolls of this region as feeding on the seeds of dwarf birch (*Betula nana*), canoe birch (*Betula papyrifera*), and two alders (*Alnus incana* and *A. alnobetula* [=*sinuata*]). The six stomachs collected by Preble contained seeds of birch and alder. The remaining five from Michigan and Maine contained seeds of knotweed (*Polygonum*), stink grass (*Eragrostis*), sedge (*Carex*), pigweed (*Amaranthus*), and an unidentified seed.

The food of this redpoll probably differs little from that of the common redpoll (*Acanthis linaria*), which is discussed at greater length in the succeeding section.

[18] A biological investigation of the Athabaska-Mackenzie region: U. S. Dept. Agr., North Amer. Fauna No. 27, p. 418, 1908.

COMMON REDPOLL (*Acanthis linaria*).

(PLATE III).

The hardy little redpolls breeding in the far north and coming south into the United States only during the winter months may be readily recognized by their sparrow-like appearance and bright red cap. Usually a small percentage of the flocks show on their breasts more or less of the red that marks the adult males. These birds appear as irregular winter visitors in the Northern States; during some of the visitations they are very abundant.

For the study of this species 557 stomachs, collected in 15 States, Canada, and Alaska, were available. Of these, 550 were collected during the seven months from October to April inclusive, and the remaining 7 were scattered through the other five months.

The summer stomachs, collected in Canada, contained 25 per cent animal and 75 per cent vegetable food. The animal food consisted largely of spiders, ants, and flies, and the vegetable of seeds of various weeds and grasses. As the latter were the same as in the winter food, they will not be separately discussed.

Animal food is a negligible quantity during the winter months. One bird collected in March had eaten small cocoons (probably Tineidae) to the extent of 96 per cent of the food; and a second, taken in December, had made a meal on fly larvae and eggs of bugs. A few scattered fragments of other insects in various stomachs completed the animal food.

The vegetable food, 99.61 per cent of the total, consisted of weed seeds and seeds of birch and alder. The latter furnished the largest single item of food, 34.62 per cent of the total. A large series of stomachs from New Hampshire and a second series from Ontario contained little besides alder seeds. Various weed seeds amounted to 51.66 per cent of the food. Ragweed (*Ambrosia*), lambs-quarters (*Chenopodium*), pigweed (*Amaranthus*), smartweed (*Polygonum*), and catnip (*Nepeta cataria*) were taken most frequently. Ragweed is a favorite food of the species; it was found in 207 stomachs and amounted to 24.7 per cent of the total. The stomachs containing these seeds were collected in many localities throughout the Northern States and show that the birds feed on this weed wherever found. On the other hand, practically all the birch and alder seeds found in 185 stomachs were from only three places. Of the total food, 11.81 per cent consisted of seeds of lambs-quarters and 4.79 per cent seeds of pigweed. Seeds of grasses and a few other seeds, fruits, and rubbish composed the remainder of the food.

Food items of the common redpoll, identified to the genus or species, as determined by the examination of 557 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Poaceae.		Cyperaceae.	
Chaetochloa viridis (green foxtail)	1	*Carex* sp. (sedge)	4
Chaetochloa sp. (foxtail grass)	9	Salicaceae.	
Phleum pratense (timothy)	2	*Salix* sp. (willow) (buds)	3
Panicum sp. (switchgrass)	1	Betulaceae.	
		Betula sp. (birch)	110
		Alnus incana (speckled alder)	4

Betulaceae—Continued.	
Alnus sp. (alder)	103
Polygonaceae.	
Eriogonum sp.	40
Polygonum punctatum (smartweed)	1
Polygonum sp. (smartweed)	55
Chenopodiaceae.	
Chenopodium album (lambsquarters)	30
Chenopodium sp. (goosefoot)	132
Amaranthaceae.	
Amaranthus sp. (pigweed)	65
Portulacaceae.	
Portulaca oleracea (purslane)	7
Brassicaceae.	
Campe sp. (wintercress)	4
Rosaceae.	
Rubus sp. (blackberry)	1
Vacciniaceae.	
Gaylussacia sp. (huckleberry)	1
Verbenaceae.	
Verbena sp.	1
Menthaceae.	
Nepeta cataria (catnip)	29
Caprifoliaceae.	
Viburnum sp. (blackhaw)	7
Ambrosiaceae.	
Ambrosia elatior (ragweed)	18
Ambrosia sp. (ragweed)	189
Asteraceae.	
Bidens sp. (Spanish needles)	1

PINE SISKIN (*Spinus pinus*).

(PLATE III).

The pine siskin is another species best known to the people of the United States as an irregular winter visitor. Its dull streaked plumage and goldfinch-like flight are more or less familiar to observers throughout the country, though it is more common in the Northern States. It breeds chiefly in the great belt of coniferous timber of the Canadian Zone, which lies almost wholly beyond the borders of the United States, except in the mountains. In this country it breeds in northern Minnesota and Michigan, and in the mountains as far south as North Carolina in the East and to the Mexican border in the West.

For a study of the food of the pine siskin 291 stomachs from 20 States, the District of Columbia, and Canada were available. Of these, 266 were collected during the months from October to May, inclusive, this being the season during which the species is most common in this country; only 25 were taken during the remainder of the year.

Winter food.—Examination of stomachs taken during the winter months shows that seeds of conifers, alder, birch, and of weeds of various kinds are the principal food of the pine siskin at this season. Seventy stomachs contained coniferous seeds to the extent of 23.28 per cent of the season's food. Siskins, in common with many other seed-eating birds, usually make an entire meal on a single food, and consequently seeds of conifers constituted 100 per cent of the contents of nearly all stomachs in which they occurred. Forty-eight birds were found to have eaten birch or alder seeds practically to the exclusion of all other foods. In many stomachs distinction between these two kinds of seeds could not be made in the fragmentary condition in which they were usually found. Of the winter's food 18.69 per cent consisted of seeds of these two plants. Seventy-six birds had eaten weed seed, which comprised 24.58 per cent of the season's food. In the Eastern States ragweed (*Ambrosia elatior*), found in 27 stomachs, was most commonly taken, while in California 28 birds had eaten seeds of groundsel (*Senecio*). Various other seeds were occasionally taken but rarely in any quantity.

REDPOLLS, FEMALE AND MALE (UPPER FIGURES) AND PINE SISKIN (LOWER)

B2337M

SNOW BUNTING (UPPER FIGURE) AND LAPLAND LONGSPUR (LOWER)

The pine siskin hulled the seeds eaten more consistently than any other bird considered in this bulletin, and consequently 34 stomachs were found in which the hulled and finely divided seed fragments could not be identified. This material constituted the remaining 20.15 per cent of the 86.7 per cent of vegetable matter in the winter food.

Of the 13.3 per cent animal matter in the winter food, caterpillars, found in 17 stomachs to the extent of 7.31 per cent of the total, were the most important single item. Four November stomachs collected at Rockaway Beach, N. Y., were filled with tortricid larvae (leaf-rollers). Eleven birds, collected in various parts of the country in April and May, had fed chiefly or entirely on caterpillars, while six had taken plant-lice (Aphididae) to the extent of 1.38 per cent of the food. One California bird had eaten more than 300 plant-lice, which formed 42 per cent of the stomach contents. A bird taken in North Carolina during an outbreak of grain aphids had fed exclusively on them, 80 being counted. Two others had made 98 and 100 per cent of their food of plant-lice. The stomach contents of seven birds taken in one locality in California during March and April averaged 90 per cent black olive scales (*Saissetia oleæ*), a very destructive pest of the olive. In March over 12 per cent of the total food was made up of this insect, and it constituted 2.17 per cent of the total food for the season. The remaining 2.44 per cent of insect food consisted of fragments of beetles, grasshoppers, and other insects.

Summer food.—The 25 stomachs collected in the four months from June to September came from widely separated localities, mostly from the mountainous regions of the West. Animal matter formed 28.08 per cent of the contents of these, and vegetable matter 71.92 per cent. Three birds had eaten plant-lice, which constituted 8.48 per cent of the food for this season; two, one of which had eaten nothing else, had taken caterpillars to the extent of 4.68 per cent of the food, and the remaining 14.92 per cent of animal matter consisted of spiders, bugs, fly larvae, weevils, and other insects.

Of the vegetable food, coniferous seeds formed 20 per cent, weed seeds 19.2 per cent, and miscellaneous plant matter from a number of stomachs in which the contents were very finely divided, 32.72 per cent.

Various seeds other than those found in the stomachs examined have been mentioned in ornithological literature as constituting part of the food of the pine siskin. Among these are seeds of sweetgum (*Liquidambar styraciflua*), willow (*Salix*), juniper (*Juniperus*), and plantain (*Plantago*). Buds also are occasionally eaten, this habit causing the only complaint recorded against the species. This occurred in 1886, when a large number of pine siskins appeared in one locality in Oregon and fed extensively on the buds of fruit trees. No other charges have been made against the species on this ground, so that it seems safe to assume that this is not a regular habit of the bird but a local occurrence caused by unusual conditions. Normally the siskins are rarely present in sufficient numbers to do extensive damage, even if the bud-eating habit were much more highly developed than is now apparent.

Conclusions.—The evidence from stomach examination is strongly in the pine siskin's favor. Buds are occasionally eaten locally, but the vegetable food appears to be made up largely of seeds of weeds and other noncultivated plants. In its destruction of aphids, scale insects, and caterpillars the bird renders such valuable service as to entitle it to higher rank economically than most of the species treated in this bulletin.

Food items of the pine siskin, identified to the genus or species, as determined by the examination of 291 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Pinaceae.	
Pinus virginiana (scrub pine)	2
Tsuga canadensis (hemlock)	37
Pseudotsuga mucronata (Douglas fir)	1
Poaceae.	
Chaetochloa sp. (foxtail grass)	1
Betulaceae.	
Betula sp. (birch) or *Alnus* sp. (alder)	46
Ulmaceae.	
Ulmus sp. (elm)	2
Polygonaceae.	
Polygonum sp. (smartweed)	1
Amaranthaceae.	
Amaranthus sp. (pigweed)	4
Silenaceae.	
Alsine sp. (chickweed)	3
Silene sp. (catchfly)	1
Portulacaceae.	
Montia sp. (water-chickweed)	2
Rosaceae.	
Rubus sp. (blackberry)	1
Fabaceae.	
Trifolium sp. (clover)	1
Geraniaceae.	
Erodium sp. (alfilaria)	7
Oleaceae.	
Syringa vulgaris (lilac)	1
Ambrosiaceae.	
Ambrosia elatior	27
Menthaceae.	
Nepeta cataria (catnip)	1
Asteraceae.	
Helianthus sp. (sunflower)	2
Senecio sp. (ragwort)	29

ANIMAL FOOD.

Coccidae (scale insects).	
Saissetia oleae (black olive scale)	7
Aphididae (plant-lice).	
Siphocoryne sp. (grain aphid)	1
Curculionidae (weevils).	
Phytonomus posticus (alfalfa weevil)	1

SNOW BUNTING *(Plectrophenax nivalis).*

(PLATE IV.)

The snow bunting, or snowflake, is an easily recognized winter sparrow in northern United States, the distinct black-and-white or brown-and-white appearance being totally unlike any other member of the family. It breeds in the far North and appears regularly in winter only in the Northern States, where it is often found associated in flocks with shore larks and longspurs.

Very little has been written concerning the food of the snow bunting, writers usually confining themselves to the statement that the bird is fond of weeds or grass seeds. Doctor Judd's account of the food of this bird[19] was based on an examination of 46

[19] The relation of sparrows to agriculture: U. S. Dept. Agr., Biol. Surv. Bull. No. 15, pp. 52–53, 1901.

stomachs collected in New York, Michigan, Wisconsin, and Ontario. He found that seeds of ragweed (*Ambrosia*), pigweed (*Amaranthus*), and grain formed the chief foods. The present report is based on the examination of 461 stomachs taken in 11 States, Alaska, and 5 Provinces of Canada, representing every month of the year. Of these, 418 were collected in the seven months from October to April inclusive, this being the period during which the birds appear in the United States. The 43 stomachs collected during the remaining five months came from the Pribilof Islands, northern Saskatchewan, northern Ontario, and northern Quebec.

The food of the snow bunting during the seven months in which it may be found in this country is designated in this bulletin as winter food, while that taken during the other five months of the year will be called summer food, although neither term is strictly accurate.

Winter food.—In the examination of the 418 stomachs collected during the winter period it was found that 3.42 per cent of the food was animal and 96.58 per cent vegetable. The animal food was taken exclusively in March, October, and November. One stomach taken in March contained five clover-root curculios (*Sitona hispidulus*), which formed 52 per cent of the contents. This, together with a few other beetle fragments in other stomachs, formed 0.88 per cent of the food in the 73 stomachs collected in this month. Fragments of caterpillars and bugs in three stomachs constituted 0.37 per cent of the food, while spiders, sowbugs, and miscellaneous animal matter in three stomachs formed 0.86 per cent of the food.

Of 24 birds collected in October, 7 had eaten animal food to the extent of 13.54 per cent of the total for the month. Two had eaten beetles to the extent of 0.21 per cent of the monthly food. One October bird collected in Labrador had eaten at least 60 dipterous larvae, which constituted the entire stomach contents. Two Ontario birds had each made 60 per cent of their meal on caterpillars, while another from the same locality had eaten nothing else. The insect food of the four last-mentioned October birds, together with that of three others which had taken small quantities, constituted 13.33 per cent of the monthly food.

Of 27 birds collected in November, 12 had taken animal food of various kinds in small quantities. Beetles formed 0.85 per cent of the food of these birds; other insects (chiefly caterpillars) made up 6.26 per cent, and spiders and miscellaneous animal matter 0.96 per cent, or a total of 8.07 per cent.

A large variety of seeds constituted the 96.58 per cent of vegetable food during the winter period. The character of this food varied with the locality rather than the season. Thus, a large number of birds collected in Wisconsin at various times over a number of years had all fed extensively on the seeds of foxtail grass (*Chaetochloa*), ragweed (*Ambrosia*), goosefoot (*Chenopodium*), and pigweed (*Amaranthus*). Birds collected on Shelter Island, N. Y., under similar conditions had fed extensively on grass seed; while a large number collected around Hudson Bay had fed largely on grasses of other species. A number of April birds from Saskatchewan had eaten little but seeds of sedge and wheat, the latter waste grain picked up about straw stacks.

Grass seeds of many species furnished the largest single item in the stomach contents of the 418 birds, 31.16 per cent coming from this source. Of this the seeds of yellow foxtail (*Chaetochloa lutescens*) and green foxtail (*Chaetochloa viridis*), both common weeds in cultivated farm lands, furnished 11.83 per cent. A large number of birds taken on Long Island and Shelter Island, N. Y., had fed freely on the seeds of sandgrass (*Triplasis purpurea*), which constituted 4.43 per cent of the food. Seeds of numerous other grasses, no one of which formed a large percentage, together constituted the remaining 14.90 per cent of grass seed.

Seeds of sedges found in many stomachs in moderate quantities formed 8.50 per cent of the food for this season. Seeds of various species of *Polygonum*, among which black-bindweed (*P. convolvulus*) and smartweed (*P. lapathifolium*) were most frequently found, constituted 3.72 per cent of the food.

Seeds of various species of goosefoot (*Chenopodium*), mostly of lambs-quarters (*C. album*), formed 5.48 per cent of the food, and those of pigweed (*Amaranthus*), 5.56 per cent. A large variety of other seeds, including a number which could not be identified but no one of which formed any considerable proportion of the whole, made up 11.46 per cent. Seeds of ragweed (*Ambrosia elatior*) were a favorite food and constituted 9.42 per cent of the total.

Wheat formed 13.09 per cent of the total food; and all other grains, including corn, oats, and barley, 4.72 per cent. From the conditions under which much of this was obtained it must have been largely waste grain. In April, 56.4 per cent of the total food consisted of grain, of which 41.01 per cent was wheat. This percentage is high because a series of 37 of the 64 birds collected for the month were taken while feeding on old stack bottoms, so that the stomachs contained little except grain. A considerable portion of the grain taken during other months was from birds collected under similar conditions and can not be held against the species.

The remaining 3.47 per cent is made up of unrecognizable vegetable débris, usually so finely ground as to make any attempt at identification useless.

Some of the various seeds were occasionally taken in large numbers. One March bird from Massachusetts had eaten 1,250 seeds of goosefoot (*Chenopodium*), 175 of pigweed (*Amaranthus*), 1 of ragweed (*Ambrosia*), and 12 grass seeds, while another from the same locality had its stomach and gullet packed with 2,000 seeds of goosefoot (*Chenopodium*), 12 of smartweed (*Polygonum*), 7 of *Ambrosia*, 2 of hair grass (*Paspalum*), 50 of wild mustard (*Brassica arvensis*), and 1 unidentified grass seed. A bird taken on Shelter Island, N. Y., had also eaten a large number of seeds, 720 *Chenopodium*, 1 *Amaranthus*, and 480 meadow fescue (*Festuca elatior*) seeds being identified. Birds from various localities which had eaten from 100 to 500 seeds were numerous.

Summer food.—The contents of the 43 stomachs collected from May to September consisted of 29.26 per cent animal matter and 70.74 per cent vegetable. Practically all these stomachs were taken on the shores of Hudson Bay and on the Pribilof Islands. Beetles, mostly *Chrysomela subsulcata*, constituted 3.79 per cent of the food. Other insects, fly eggs, pupae, and adults, particularly those of crane-

flies, were the most important animal food, 16 of the 43 birds having eaten them to the extent of 25.45 per cent of the food. Fragments of spiders furnished the remaining 0.02 per cent of the animal matter taken.

Grass seed formed 28.63 per cent; sedges, 7.02; seeds of smartweed (*Polygonum*), 0.23 per cent; goosefoot (*Chenopodium*), 0.93 per cent; ragweed (*Ambrosia*), 4.42 per cent; grain, 1.16 per cent; and a considerable variety of other seeds 28.35 per cent of the summer food.

Conclusions.—It would seem that very little can be said either for or against the snow bunting. During the season when the bird is in settled areas its animal food is of little consequence, and the eating of weed seeds is of no particular economic importance. However, the bird does no harm and may well continue to receive the protection now accorded it.

Food items of the snow bunting, identified to the genus or species, as determined by the examination of 461 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Najadaceae.	
Najas flexilis (bushy pondweed)	1
Najas sp. (pondweed)	9
Poaceae.	
Syntherisma sanguinalis (crabgrass)	1
Syntherisma ischaemum (crabgrass)	1
Paspalum setaceum (hairgrass)	1
Paspalum sp. (hairgrass)	2
Echinochloa crusgalli (wild millet)	3
Panicum capillare (witchgrass)	5
Panicum virgatum (switchgrass)	3
Chaetochloa lutescens (yellow foxtail)	58
Chaetochloa viridis (green foxtail)	117
Phleum pratense (timothy)	8
Sporobolus vaginaeflorus (dropseed)	5
Sporobolus neglectus (dropseed)	10
Ammophila arenaria (beachgrass)	7
Avena sativa (oats)	21
Triplasis purpurea (sandgrass)	33
Festuca rubra (red fescue)	1
Festuca elatior (meadow fescue)	3
Agropyron repens (quackgrass)	5
Hordeum sp. (barley)	14
Triticum aestivum (wheat)	90
Poaceae—Continued	
Elymus sp. (wild rye)	9
Zea mays (corn)	4
Cyperaceae.	
Scirpus sp. (bulrush)	21
Carex sp. (sedge)	74
Juncaceae.	
Juncus sp. (rush)	4
Myricaceae.	
Myrica carolinensis (northern bayberry)	1
Polygonaceae.	
Rumex sp. (dock)	1
Polygonum lapathifolium (smartweed)	63
Polygonum pennsylvanicum (smartweed)	2
Polygonum convolvulus (bindweed)	13
Chenopodiaceae.	
Chenopodium album (lambsquarters)	74
Salsola kali (saltwort)	1
Amaranthaceae.	
Amaranthus sp. (pigweed)	87
Silenaceae.	
Arenaria peploides (sandwort)	3
Silene acaulis (moss campion)	1
Silene latifolia (bladder campion)	1
Portulacaceae.	
Montia fontana (waterchickweed)	1
Portulaca sp. (purslane)	3
Ranunculaceae.	
Ranunculus sp. (buttercup)	11

Brassicaceae.
Brassica arvensis (wild mustard) ---------- 2
Rosaceae.
Potentilla sp. (cinquefoil) --- 21
Rubus sp. (blackberry) ---- 4
Fabaceae.
Trifolium sp. (clover) ------ 5
Empetraceae.
Empetrum nigrum (crowberry) ---------- 13
Vitaceae.
Parthenocissus quinquefolia (Virginia creeper) ------- 1
Haloragidaceae.
Hippuris vulgaris (bottlebrush) ---------- 3
Ericaceae.
Ledum sp. (Labrador-tea) -- 2
Vacciniaceae.
Vaccinium sp. (blueberry) -- 1
Verbenaceae.
Verbena sp---------- 2
Scrophulariaceae.
Pedicularis sp. (lousewort) -- 4
Ambrosiaceae.
Ambrosia elatior (ragweed) - 165
Asteraceae.
Bidens sp. (Spanish-needles) - 1

ANIMAL FOOD.

Delphacidae (frog-hoppers).
Stenocranus sp---------- 1
Carabidae (ground-beetles).
Pterostichus sp---------- 2
Amara sp---------- 2
Hydrophilidae (water scavenger beetles).
Cercyon haemorrhoidalis---- 1
Histeridae (shining carrion-beetles).
Hister sp---------- 1
Aegialitidae (beach-beetles).
Aegialites californicus------- 1
Scarabaeidae (dung-beetles).
Aphodius distinctus--------- 2
Chrysomelidae (leaf-beetles).
Chrysomela subsulcata------ 5
Curculionidae (weevils).
Sitona hispidulus (clover root-borer) ---------- 2

LAPLAND LONGSPUR *(Calcarius lapponicus).*

(PLATE IV.)

Breeding far to the north, usually beyond the tree limit, the Lapland longspur comes south in winter to the northern United States. It appears more or less commonly in the States north of the Ohio and Potomac Rivers, but in greatest numbers in the northern Plains States. In its far northern summer home the males are rather conspicuously dressed, having a black throat and breast and a rather bright rufous nape added to the usual sparrow garb. In winter the male wears a plumage similar to that of the female, a sparrowlike back of black and browns, and white underparts more or less streaked with brown or black. In any plumage it may be distinguished from most other sparrows by the elongated hind claw.

Little has been written regarding the food of this species other than Judd's account,[20] based on the examination of 113 stomachs. The present study comprises 656 stomachs (including those used by Judd) collected in 15 States, Alaska, and 5 Provinces of Canada during every month of the year. As in the discussion of other species considered in this bulletin, the data on food have been divided roughly into winter and summer categories, the winter division corresponding roughly with the months during which the species is found within the United States and the summer months including only the time spent in the northern home. Owing to the rather prolonged stay of the Lapland longspur in this country the eight months from October to May, inclusive, are considered as winter months

[20] The relation of sparrows to agriculture: U. S. Dept. Agr., Biol. Surv. Bull. No. 15, pp. 54–55, 1901.

and the remaining four, represented by 56 stomachs collected in Alaska and northern Canada, are discussed as summer months.

Winter food.—Unfortunately over half the 600 stomachs used in the study of winter food were collected in Kansas under very similar conditions. They were all taken in January and February and tend to give undue prominence to millet and crabgrass, the seeds of which constituted over 75 per cent of the January food and over 65 per cent of that eaten in February. As the millet was all waste grain picked up in the stubble, this high proportion of a grain can not be held against the bird.

Only 3.97 per cent of the food for the eight winter months consisted of animal matter and nearly half of this was taken in April by four birds that had fed almost exclusively on carabids of the genera *Platynus*, *Amara*, and possibly others. The remainder consisted of chrysomelids, weevils, fly larvae, caterpillars, and spiders taken in varying quantities in every month except February.

Of the 96.03 per cent of vegetable food, 61.73 per cent is represented by grass seeds of various kinds, 30.56 per cent being the seeds of foxtail (*Chaetochloa lutescens* and *C. viridis*) eaten commonly by birds from all parts of the country. Cultivated millet (*Setaria italica*), a closely related plant, contributed 10.01 per cent of the food. The seeds of these grasses are comparatively large, easy to obtain, and plentiful, and the birds make the most of them.

Seeds of crabgrass (*Syntherisma sanguinalis*) formed 8.66 per cent of the food, but most of them had been eaten by birds collected in one locality in Kansas. Seeds of various species of witchgrass (*Panicum*) made up 2.25 per cent of the food, and other grasses, among which crabgrass (*Syntherisma ischaemum*), wild millet (*Echinochloa crusgalli*), and goosegrass (*Eleusine indica*) were frequently taken, furnished 10.51 per cent of the total.

Sedges of various species had been eaten to the extent of 10.25 per cent of the food, chiefly by birds taken in Montana, Ontario, and Northwest Territories. Seventeen birds taken in October had eaten sedge seed to the extent of 64.42 per cent of the food, while over 8 per cent of the subsistence for the months of April and May was from this source. Seeds of purslane (*Portulaca*) were common in the food, but being such small seeds they made only 0.82 per cent of the bulk. Seeds of pigweed (*Amaranthus*) were freely eaten, 6.03 per cent of the total coming from the various species of this genus; and 6.49 per cent consisted of miscellaneous weed seed, among which goosefoot (*Chenopodium*) and ragweed (*Ambrosia*) were most common.

Wheat formed 8.33 per cent of the food and was eaten in every one of the eight months except October. Three birds collected while feeding on a newly sown field had eaten seeds of timothy and wheat, and it is possible that the species may do some damage by picking up newly sown grain or grass seeds. Other grain, chiefly oats, and all of it waste, had been eaten to the extent of 1.41 per cent of the food. Fragments of grass and unidentified vegetable débris made up the remaining 0.97 per cent of the food.

Summer food.—The food of the 56 birds collected in the months from June to September in Alaska or northern Canada consisted

of 47.43 per cent animal and 52.57 per cent vegetable matter. Beetles, mostly chrysomelids and weevils, made up 11.91 per cent of the summer food. Fly remains, almost entirely the eggs and adults of crane-flies (Tipulidae), constituted 17.77 per cent. The remaining 17.75 per cent animal food consisted of caterpillars, spiders, bugs, and fragments of other insects.

Grass seeds formed 12.02 per cent of the summer food; seeds of sedges, 4.16 per cent; and those of a variety of other plants, 27.86 per cent. No one of these had been taken consistently enough to make a large proportion of the total. The remaining 8.53 per cent consisted of bits of grass and unidentified vegetable débris.

Conclusions.—While in the United States, the Lapland longspur can not be said to be either strongly beneficial or injurious. The number of insects eaten is insignificant, but the bird is entitled to credit for whatever good it may do by eating weed seed. The bird's fondness for millet and other grass seeds might make it a nuisance were it not for the fact that it is rarely in the country when millet is sown or harvested.

Food items of the Lapland longspur, identified to the genus or species, as determined by the examination of 656 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Poaceae.	
Syntherisma sanguinalis (crabgrass)	228
Syntherisma ischaemum (crabgrass)	26
Echinochloa crusgalli (wild millet)	11
Panicum capillare (witchgrass)	8
Chaetochloa lutescens (yellow foxtail)	19
Chaetochloa viridis (green foxtail)	66
Setaria italica (millet)	266
Phleum pratense (timothy)	4
Ammophila arenaria (beachgrass)	1
Avena sativa (oats)	17
Eleusine indica (goosegrass)	6
Triplasis purpurea (sandgrass)	1
Eragrostis sp. (love grass)	1
Festuca rubra (red fescue)	1
Hordeum sp. (barley)	1
Triticum aestivum (wheat)	55
Zea mays (corn)	1
Cyperaceae.	
Scirpus sp. (bulrush)	8
Carex sp. (sedge)	33
Polygonaceae.	
Polygonum lapathifolium (smartweed)	10
Polygonum convolvulus (bindweed)	1
Chenopodiaceae.	
Chenopodium album (lambsquarters)	19
Amaranthaceae.	
Amaranthus retroflexus (pigweed)	1
Amaranthus spinosus (pigweed)	9
Silenaceae.	
Arenaria peploides (sandwort)	2
Silene sp. (campion)	1
Portulacaceae.	
Portulaca oleracea (purslane)	104
Ranuculaceae.	
Ranunculus sp. (buttercup)	10
Papaveraceae.	
Papaver macounii (poppy)	1
Rosaceae.	
Potentilla sp. (cinquefoil)	6
Fragaria sp. (strawberry)	1
Empetraceae.	
Empetrum nigrum (crowberry)	3
Violaceae.	
Viola langsdorfii (violet)	4
Cornaceae.	
Cornus canadensis (bunchberry)	6
Vacciniaceae.	
Vaccinium sp. (blueberry)	1
Gentianaceae.	
Gentiana sp.	1

Verbenaceae.	
Verbena sp.	10
Caprifoliaceae.	
Symphoricarpos sp. (snowberry)	1
Ambrosiaceae.	
Ambrosia elatior (ragweed)	17
Asteraceae.	
Helianthus sp. (sunflower)	9

ANIMAL FOOD.

Carabidae (ground-beetles).	
Amara sp.	2
Platynus sp.	3
Silphidae (carrion-beetles).	
Silpha opaca	1
Scarabaeidae (dung-beetles).	
Aphodius inquinatus	3
Chrysomelidae (leaf beetles).	
Chrysomela subsulcata	2
Altica sp.	1
Curculionidae (weevils).	
Sitona hispidulus (clover-root curculio)	1
Lophalophus inquinatus	8
Anthomyiidae.	
Fucellia sp. (kelp fly)	1
Ichneumonidae (parasitic wasps).	
Pterocormus sp.	1
Agelenidae (spiders).	
Tegenaria derhami	1

SMITH LONGSPUR (*Calcarius pictus*).

Only 30 stomachs of the Smith longspur were available for examination. Of these 21 were collected in Illinois in April and 9 at Fort Simpson, Northwest Territories, during May. This number is not large enough to afford data as to the general nature of the food of the species, but when these stomachs and those of Lapland longspurs collected in the same localities during the same months are compared, the feeding habits of the two appear very similar. In these 30 stomachs 37.1 per cent was animal matter and 62.9 per cent vegetable.

The nine birds taken at Fort Simpson had all been feeding almost exclusively on insects, while those taken in Illinois had fed nearly to the same extent on seeds. Carabids of various species were found in 12 stomachs and formed 21.2 per cent of the food. Six birds had eaten click-beetles, which constituted 3.7 per cent of the food. Other beetles had been taken to the extent of 0.93 per cent of the food. Caterpillars, eaten largely by the birds from Illinois, formed 7.47 per cent; other insects (chiefly grasshoppers and crickets), 3.53 per cent; and spiders, 0.27 per cent of the total.

Seeds of long-leaved rush grass (*Sporobolus asper*) had been eaten largely by a number of Illinois birds and formed 28.67 per cent of the total food. As with the Lapland longspur, seeds of various grasses seem to be sought, since, in addition to the *Sporobolus*, 12.07 per cent of the food was foxtail (*Chaetochloa lutescens* and *C. viridis*), 7.33 per cent witchgrass (*Panicum*), and 4.73 per cent the seeds of various other grasses, making grass seeds total 52.8 per cent of the food. Weed seeds, chiefly ragweed (*Ambrosia elatior*), constituted 1.63 per cent of the total; wheat, 4.67 per cent; barley, 0.67 per cent; and vegetable débris, 3.13 per cent.

Food items of the Smith longspur, identified to the genus or species, as determined by the examination of 30 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Poaceae.	
Syntherisma ischaemum (crabgrass)	1
Panicum capillare (witchgrass)	4
Poaceae—Continued	
Echinochloa crusgalli (wild millet)	2
Chaetochloa lutescens (yellow foxtail)	16

Poaceae—Continued.	
Chaetochloa viridis (green foxtail)	2
Phleum pratense (timothy)	1
Sporobolus asper (dropseed)	14
Hordeum sp. (barley)	1
Triticum aestivum (wheat)	2
Eleusine indica (goosegrass)	3
Cyperaceae.	
Scirpus sp. (bulrush)	1
Carex sp. (sedge)	1
Fabaceae.	
Trifolium sp. (clover)	1
Euphorbiaceae.	
Euphorbia sp	1
Ambrosiaceae.	
Ambrosia elatior (ragweed)	3

ANIMAL FOOD.

Carabidae (ground-beetles).	
Amara sp	2
Platynus sp	1
Anisodactylus sp	3
Histeridae (shining carrion-beetles.	
Hister sp	1
Calandridae.	
Sphenophorus sp. (billbug)	1

CHESTNUT-COLLARED LONGSPUR (*Calcarius ornatus*).[21]

The chestnut-collared longspur breeds on the Plains from Kansas north into southern Canada and winters from Nebraska south into Mexico.

Only 40 stomachs of this longspur were available for examination, a number which is not large enough to furnish a basis for reliable conclusions regarding the food. Of these, 7 were collected in Texas in December, and the remaining 33 were taken in 6 States during the months from May to September, inclusive. Animal matter formed 31.05 per cent of the content and vegetable matter 68.95 per cent.

Coleoptera, chiefly leaf-beetles (Chrysomelidae) and weevils, had been eaten to the extent of 6.97 per cent of the total; but crickets and grasshoppers were the chief animal food, 13.08 per cent of the entire diet being from this source. Bugs (Hemiptera) formed 4 per cent, caterpillars and adult moths 5.7 per cent, other insects (largely ants) 0.93 per cent, and spiders 0.37 per cent of the total.

Grass seeds formed over half the vegetable food (35.48 per cent of the total), 4.1 per cent of which was witchgrass (*Panicum*) and the remainder a number of species in small quantities. A number of Montana birds had eaten wheat, 15.33 per cent of the food being from this source, while all other grains made 6.12 per cent of the food. Weed seed, chiefly goosefoot (*Chenopodium*) and pigweed (*Amaranthus*), formed 8.85 per cent of the total; 0.5 per cent was formed by unidentified seeds, and 2.67 per cent by vegetable débris.

Food items of the chestnut-collared longspur, identified to the genus or species, as determined by the examination of 40 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Poaceae.	
Panicum capillare (witchgrass)	7
Panicum wilcoxianum (witchgrass)	1
Chaetochloa viridis (green foxtail)	2
Stipa sp. (feathergrass)	1
Sporobolus asper (dropseed)	2
Triticum aestivum (wheat)	7
Cyperaceae.	
Carex sp. (sedge)	1
Chenopodiaceae.	
Chenopodium sp. (goosefoot)	6
Amaranthaceae.	
Amaranthus sp. (pigweed)	3
Asteraceae.	
Helianthus sp. (sunflower)	4

[21] The chestnut-collared and McCown longspurs, while breeding largely in the United States, and not therefore winter visitants, are treated in the present bulletin in order that the published account of the food of the longspurs may be complete.

ANIMAL FOOD.

Acrididae (grasshoppers).	
Melanoplus sp	1
Elateridae (wireworms).	
Limonius sp	1
Tenebrionidae (darkling-beetles).	
Blapstinus sp	1

McCOWN LONGSPUR (*Rhynchophanes mccowni*).[23]

The McCown longspur has a breeding and wintering range very similar to that of the chestnut-collared longspur. Little information is at hand regarding its food, as only 19 stomachs from four States and 1 from Saskatchewan were available for examination. All were collected in the months from April to October inclusive.

The following are the percentages of the various food items found: Beetles, largely weevils, 7.26; grasshoppers, 6.53; other insects, 5.79; grass seeds, 10; sedge seeds, 25.16; pigweed, 1.37; sunflower, 10.63; wheat, 15.53; other seeds, 16.16; and vegetable débris, 1.57. The total animal matter was 19.58 per cent and the vegetable matter 80.42 per cent.

Food items of the McCown longspur, identified to the genus or species, as determined by the examination of 19 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Poaceae.	
Chaetochloa viridis (green foxtail)	1
Bouteloua sp. (grama)	1
Stipa sp. (feathergrass)	1
Triticum aestivum (wheat)	4
Cyperaceae.	
Carex sp. (sedge)	6
Chenopodiaceae.	
Chenopodium sp. (goosefoot)	5
Amaranthaceae.	
Amaranthus sp. (pigweed)	4
Polygonaceae.	
Polygonum convolvulus (bindweed)	1
Boraginaceae.	
Lithospermum sp. (puccoon)	1
Ambrosiaceae.	
Ambrosia sp. (ragweed)	1
Asteraceae.	
Helianthus sp. (sunflower)	4

ANIMAL FOOD.

Scarabaeidae (dung-beetles).	
Aphodius sp	2

COMMON PIPIT (*Anthus spinoletta rubescens*).

(PLATE V.)

The common pipit, a small ground-loving bird, in appearance suggesting a warbler, breeds in the mountains and the far North and appears in varying numbers throughout most of the United States during migration and in winter. Examinations were made of 301 stomachs, of which 284 contained enough food to be used in this study. These were taken in 26 States, the District of Columbia, Alaska, and Canada, every month of the year being represented. Unlike the other birds thus far discussed in this bulletin, the pipit was found to be largely insectivorous, 84.67 per cent of its food being of animal origin and only 15.33 per cent vegetable.

[23] See footnote 21, on page 26.

Animal food.—Millipeds, crustaceans, and other miscellaneous animal matter constituted 1.58 per cent of the food; spiders, 6.03 per cent; and insects, 77.06 per cent. While neither all ground-beetles (Carabidae), 3.76 per cent of the food, nor all wasps, bees, and the like (Hymenoptera), 8.62 per cent, are beneficial, many of them are predacious or parasitic, and therefore useful. It is not to be overlooked, however, that approximately half of the Hymenoptera in the food of the pipit consisted of ants, the destruction of which is to be commended. The remaining insect food, 64.68 per cent, was taken for the most part from injurious groups, although a few water beetles and neuropterous insects of more or less neutral economic significance were included.

Beetles were present in the food more than any other order of insects, totaling 23.51 per cent and divided among the various groups with the percentages indicated, as follows: Ground-beetles (Carabidae), 3.76; leaf-beetles (Chrysomelidae), 2.78; leaf-chafers and dung-beetles (Scarabaeidae), 3.14; weevils, 7.48; and other Coleoptera and coleopterous larvae, 6.35. Lepidopterans were the next largest item in the pipit's food, amounting to 15.41 per cent, the bulk of which was caterpillars. About half the 8.62 per cent formed by the Hymenoptera consisted of ants, and the remainder of small parasitic forms. The true bugs (Hemiptera) formed 3.64 per cent of the total food; grasshoppers and crickets (Orthoptera), 9.16 per cent; and flies and their larvae (Diptera), 10.97 per cent. The remaining 5.75 per cent in the insect food consisted of various insects, such as caddisflies, stoneflies, and other neuropterans.

The study of the food of the pipit reveals the interesting fact that the bird does its best work in the destruction of injurious insects during the winter months, when it feeds extensively on white grubs (scarabaeid larvae) and weevils. A large part of the latter are cotton-boll weevils (*Anthonomus grandis*) taken in December, January, and February in Louisiana and Texas. Thirty-six pipits had eaten these weevils, one having taken nine. As these were hibernating individuals the pipits were attacking the species at the time when its numbers are at the lowest point. The elimination of individuals at this period does far more good than the destruction of the same number during the summer. White grubs are also regularly eaten while the pipits remain in the South, being found in each of 33 stomachs.

In studying the food in detail, it is found that in 65 stomachs collected in January, carabids formed 0.46 per cent; leaf-beetles (Chrysomelidae), 2.08 per cent; white grubs (Scarabaeidae), 15.69 per cent; weevils, almost entirely cotton-boll weevils, 12.58 per cent; other beetles, 5.12 per cent; caterpillars, 5.2 per cent; ants and small parasitic Hymenoptera, 2.8 per cent; true bugs (Hemiptera), almost entirely the large nymphs of cicadas, which one would think entirely too large for so small a bird to eat, 10 per cent; grasshoppers and crickets, 11.84 per cent; flies, 1.55 per cent; other insects, 0.88 per cent; spiders, 5.8 per cent; and other animal matter, 3.43 per cent.

The most marked changes in the diet occurring during February are a decrease to 7.67 per cent in the white grubs eaten and an in-

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PIPIT

crease in weevils to 17.58 per cent. No Hemiptera were taken, although they formed a tenth of the food during the previous month.

During March the white grubs formed an insignificant portion of the diet (1.31 per cent) and the weevils dropped over half, to 7.38 per cent. In May the white grubs and their allies formed 5.38 per cent of the food, owing to the taking of adults rather than larvae, and they were not an important article in the diet for the remainder of the year. The weevils also steadily decreased until during the summer very few were eaten. In September, however, the pipits were feeding on them again, and during the last four months of the year the quantity taken fell below 10 per cent only in November, when it amounted to 8.42 per cent.

The percentage of caterpillars eaten also fluctuates considerably, May with 31.46 and September with 32.77 being the high months, although they were taken freely all summer. Most of the Hymenoptera were taken during July and August, when 44.5 per cent and 33.18 per cent respectively were recorded. These figures are undoubtedly abnormally high, because a few of the birds from Colorado and Wyoming fed almost entirely on these insects. Too few stomachs were available during the summer months to give definite results, although both Orthoptera and Diptera were eaten freely. The maximum occurred in April, when many crickets were eaten; and the maximum for Diptera, in June, when fly larvae of various kinds were taken regularly. Three birds had eaten mites (Acarina); and one, insects of the family Psocidae, forms not usually eaten by birds.

Vegetable food.—In the vegetable food of the pipit, seeds of various grasses formed 4.06 per cent of the total; various weed seeds, 8.04 per cent; grain, all of which was taken in the winter months, 1.72 per cent; and vegetable débris, 1.51 per cent. No vegetable food was taken during May, June, and July and very little in April, August, and September. In January it was made up of the seeds of various grasses (9.32 per cent), chiefly crabgrass (*Synthe-risma sanguinalis*), and seeds of several species of spurge (*Euphorbia*), 8.38 per cent. Grain gleaned from the stubble fields formed 3.54 per cent, and fragments of grass and other vegetable débris constituted the remaining 1.33 per cent. In December 51 per cent of the food was vegetable, the highest point for the year. From this month it falls rapidly away, reaching zero during the summer.

Conclusions.—From the foregoing it is evident that the pipit injures no crops, the only count against it being its destruction of a few ground beetles and parasitic hymenopterans. The remainder of its food is of a neutral or distinctly beneficial nature. It is especially worthy of note that this species does its best work during the winter months, when the consumption of insects by many other birds is at its lowest. At this time the pipit maintains a steady diet of white grubs and cotton-boll weevils, two of the worst pests in the South. The bird can hardly be commended too highly and deserves complete protection at all times.

Food items of the common pipit, identified to the genus or species, as determined by the examination of 301 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Pinaceae.	
Pinus palustris (longleaf pine)	1
Poaceae.	
Syntherisma sanguinalis (crabgrass)	32
Syntherisma ischaemum (crabgrass)	6
Brachiaria platyphylla	1
Panicum capillare (witchgrass)	10
Panicum fasciculatum (witchgrass)	1
Panicum sp (witchgrass)	4
Chaetochloa lutescens (yellow foxtail)	3
Chaetochloa sp. (foxtail)	9
Paspalum sp. (hairgrass)	1
Avena sativa (oats)	1
Dactyloctenium aegyptium (Egyptian grass)	5
Eleusine indica (goosegrass)	3
Hordeum sp. (barley)	1
Triticum aestivum (wheat)	3
Zea mays (corn)	2
Cyperaceae.	
Scirpus sp. (bulrush)	1
Carex sp. (sedge)	5
Polygonaceae.	
Rumex sp. (dock)	5
Polygonum opelousanum (smartweed)	1
Polygonum sp. (smartweed)	5
Chenopodiaceae.	
Chenopodium sp. (goosefoot)	4
Amaranthaceae.	
Amaranthus sp. (pigweed)	19
Portulacaceae.	
Calandrinia sp. (rockpurslane)	4
Corrigiolaceae.	
Scleranthus annuus (knawel)	1
Silenaceae.	
Alsine sp. (chickweed)	7
Ranunculaceae.	
Ranunculus sp. (buttercup)	1
Brassicaceae.	
Brassica sp. (wild mustard)	1
Hamamelidaceae.	
Liquidambar styraciflua (sweetgum)	1
Fabaceae.	
Trifolium sp. (clover)	4
Geraniaceae.	
Erodium sp. (alfilaria)	1
Violaceae.	
Viola langsdorfii	1
Rutaceae.	
Zanthoxylum sp. (prickly-ash)	1
Euphorbiaceae.	
Croton sp. (goatweed)	1
Acalypha virginica (Virginia copperleaf)	2
Chamaesyce serpyllifolia (spurge)	7
Chamaesyce sp. (spurge)	32
Empetraceae.	
Empetrum nigrum (crowberry)	1
Verbenaceae.	
Verbena sp.	1
Rubiaceae.	
Diodia teres (buttonweed)	1
Caprifoliaceae.	
Sambucus canadensis (elder)	1
Ambrosiaceae.	
Ambrosia elatior (ragweed)	1
Ambrosia sp. (ragweed)	1
Asteraceae.	
Helianthus sp. (sunflower)	1
Deinandra sp. (tarweed)	2
Madia sp. (tarweed)	1
Centaurea sp. (knapweed)	2

ANIMAL FOOD.

Acrididae (brown grasshoppers).	
Chortophaga viridifasciata	1
Melanoplus sp.	1
Locustidae (green grasshoppers).	
Ceuthophilus sp.	1
Gryllidae (crickets).	
Gryllus assimilis	3
Nemobius sp.	2
Scutelleridae (shield-bugs).	
Camirus porosus	2
Homaemus parvulus	1
Cydnidae (negro-bugs).	
Thyreocoris sp	1
Aethus sp.	1
Pentatomidae (stink-bugs).	
Thyanta custator	1
Thyanta sp.	1
Dendrocoris sp.	1
Coreidae.	
Corizus sp.	1
Lygaeidae.	
Nysius sp. (false chinch bug)	4

Lygaeidae—Continued
Blissus leucopterus (chinch bug) 2
Geocoris punctipes 3
Geocoris bullatus 2
Geocoris sp 8
Sphaerobius quadristriatus 1
Ligyrocoris sp 1
Reduviidae (assassin-bugs).
Atrachelus cinereus 1
Nabidae.
Nabis sp 12
Miridae (plant-bugs).
Irbisia sericans 1
Lygus sp 1
Membracidae.
Stictocephala sp 1
Bythoscopidae (leafhoppers).
Agallia 4-punctata 1
Agallia sp 1
Cicadellidae (leafhoppers).
Oncometopia lateralis 1
Helochara communis 1
Draeculacephala mollipes 2
Xerophloea viridis 2
Deltocephalus sp 1
Athysanus sp 1
Cicadula sp 1
Empoasca sp 1
Delphacidae (frog-hoppers).
Liburnia sp 1
Cicindelidae (tiger-beetles).
Cicindela sp 2
Carabidae (ground-beetles).
Bembidium sp 1
Elaphrus sp 1
Notiophilus sp 2
Pterostichus sp 1
Amara sp 4
Philophuga sp 1
Harpalus sp 1
Anisodactylus sp. 1
Agonoderus sp. 3
Tachys incurvus 1
Haliplidae (crawling water-beetles).
Haliplus triopsis 1
Peltodytes callosus 1
Peltodytes sp. 1
Hydrophilidae (water scavenger-beetles).
Enochrus nebulosus 1
Enochrus sp. 1
Staphylinidae (rove-beetles).
Stenus callosus 1
Stenus sp. 9
Atheta sp. 1
Oxytelus fuscipennis 1
Histeridae (shining scavenger-beetles).
Hister sp. 1
Elateridae (wireworms).
Lacon rectangularis 1
Monocrepidius vespertinus 2
Monocrepidius sp 5
Latridiidae.
Melanophthalma sp. 1
Coccinellidae (ladybird-beetles).
Coccinella trifasciata 1
Hippodamia convergens 3
Hippodamia sinuata 1
Hippodamia ambigua 1
Hippodamia sp. 1
Scymnus sp. 1
Tenebrionidae (darkling-beetles).
Blapstinus sp. 10
Scarabaeidae (dung-beetles).
Onthophagus tuberculifrons 2
Onthophagus sp. 1
Aphodius fimetarius 4
Aphodius fossor 1
Aphodius distinctus 5
Ataenius figurator 1
Chrysomelidae (leaf-beetles).
Calligrapha sp. 1
Graphops sp. 4
Myochrous denticollis (corn-leaf beetle) 34
Prasocuris vittata 1
Phaedon prasinella 1
Paria quadriguttata 1
Galerucella sp. 1
Monoxia sp. 1
Cerotoma trifurcata (bean leaf-beetle) 2
Chaetocnema confinis 1
Chaetocnema denticulata 1
Chaetocnema irregularis 1
Chaetocnema opacula 2
Chaetocnema sp. 14
Systena taeniata 2
Systena elongata 2
Systena sp. 6
Longitarsus montivagus 1
Microrhopala sp 1
Coptocycla sp. 2
Otiorhynchidae (weevils).
Phyxelis rigidus 5
Eudiagogus pulcher 1
Tanymecus confertus 2
Otiorhynchus ovatus (strawberry crown girdler) 3
Thricolepis inornata 1
Graphorhinus vadosus 1
Curculionidae (weevils).
Sitona hispidulus (clover-root curculio) 18
Sitona californicus 1
Sitona flavescens 9
Sitona sp. 7
Lophalophus inquinatus 2
Lepyrus sp 1
Phytonomus sp 1
Hyperodes sp. 1
Anthonomus grandis (cotton-boll weevil) 36
Baris sp. 4
Baropsis cribratus 1
Nicentrus sp. 1
Rhinoncus sp 9
Chalcodermus aeneus (cow-pea-pod weevil) 1
Chalcodermus sp. 2

Curculionidae—Continued.	
Tyloderma foveolata	3
Cylindrocopturus sp	1
Calandridae.	
Sphenophorus sp. (billbug)	4
Calandra oryzae (rice weevil)	1
Borboridae.	
Limosina sp	1
Oscinidae (frit-flies).	
Hippelates sp	1
Vipionidae (parasitic wasps).	
Apanteles sp	1
Braconidae (parasitic wasps).	
Chelonella fissus	1
Ichneumonidae (parasitic wasps).	
Mesochorus sp	1
Campoplex sp	3
Lissonota sp	1
Exolytus sp	1
Ichneumonidae—Continued.	
Agrothereutes sp	1
Phaeogenes sp	1
Pterocormus sp	3
Diapriidae.	
Galesus sp	1
Formicidae (ants).	
Solenopsis sp	4
Myrmica sp	4
Lasius sp	2
Formica subsericea	1
Formica sp	4
Halictidae (sweat-bees).	
Chloralictus zephyrus	1
Chloralictus sp	3
Attidae (jumping spiders).	
Zygoballus sp	1
Zonitidae (land snails).	
Zonitoides musculus	1

SPRAGUE PIPIT (*Anthus spragueï*).

The Sprague pipit breeds in the Great Plains region and is very similar in appearance and habits to the common pipit. Only 11 stomachs were available for examination, so that little can be stated regarding the food. In six stomachs over 75 per cent of the food consisted of grasshoppers or crickets, while 2 were well filled with seeds of goatweed (*Croton*) and spurge (*Euphorbia*). Ants and other small hymenopterans, weevils, and various other beetles, small bugs, and caterpillars formed the remainder of the food.

Food items of the Sprague pipit, identified to genus or species, as determined by the examination of 11 stomachs.

[*The figures indicate the number of stomachs in which the items were found.*]

VEGETABLE FOOD.

Poaceae.	
Panicum sp. (witchgrass)	1
Cyperaceae.	
Carex sp. (sedge)	1
Euphorbiaceae.	
Croton sp. (goatweed)	2
Euphorbia sp. (spurge)	1
Boraginaceae.	
Lithospermum sp. (puccoon)	1
Ambrosiaceae.	
Ambrosia sp. (ragweed)	1

ANIMAL FOOD.

Scutelleridae (shield-bugs).	
Phimodera torpida	1
Pentatomidae (stink-bugs).	
Euschistus sp	2
Coreidae.	
Alydus sp	1
Lygaeidae.	
Nysius sp. (false chinch bug)	5
Carabidae (ground-beetles).	
Anisodactylus sp	1
Malachiidae.	
Collops quadrimaculatus	2
Chrysomelidae (leaf-beetles).	
Graphops beryllinus	1
Graphops sp	1
Glyptoscelis sp	1
Chaetocnema sp	1
Curculionidae (weevils).	
Pachyphanes discoideus	1
Smicronyx vestitus	1
Ceutorhynchus sp	1
Rhinoncus sp	1
Formicidae (ants).	
Formica sp	2